

CAI
MS150
-69557

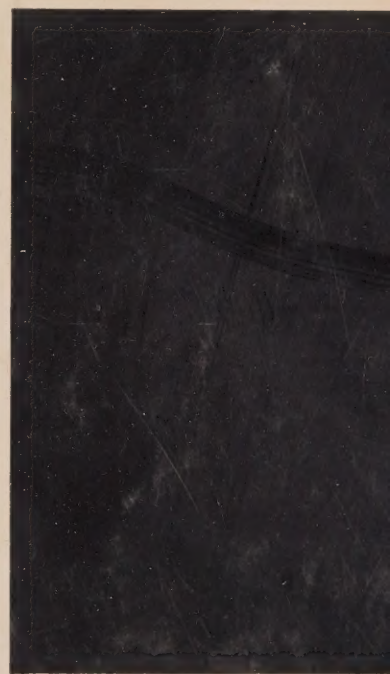
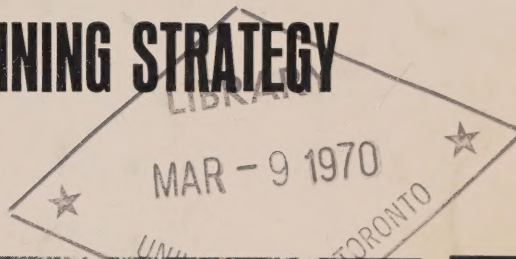
3 1761 11637456 2

Government
Publications



SOCIAL SCIENCE AND WATER MANAGEMENT: A PLANNING STRATEGY

Michel Chevalier



Policy and Planning Branch
Department of Energy,
Mines and Resources
Ottawa, Canada



© Crown Copyrights reserved
Available by mail from the Queen's Printer, Ottawa,
and at the following Canadian Government bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
Æterna-Vie Building, 1182 St. Catherine Street West

OTTAWA
Daly Building, Corner Mackenzie and Rideau

TORONTO
221 Yonge Street

WINNIPEG
Mall Center Building, 499 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price: \$1.50 Catalogue No. M27-203

Price subject to change without notice

Price subject to change without notice

Queen's Printer for Canada
Ottawa, 1970



SOCIAL SCIENCE AND WATER MANAGEMENT: A PLANNING STRATEGY

Michel Chevalier

assisted by
Jeffrey Patterson

**Policy and Planning Branch
Department of Energy,
Mines and Resources
Ottawa, Canada
1969**

PREFACE

This paper is one of four prepared for the Science Secretariat of the Privy Council (Ottawa) to review requirements for the development and use of social science in the problem of Canadian water resources management. The other papers deal with the respective roles of economic, geographical, and legal and institutional research.* A framework of four questions was posed for the review:

- (a) The major problems and issues in water management in Canada which involve economic, social, and political considerations;
- (b) Needed social science research in this connection;
- (c) The research effort to date and priorities for future studies;
- (d) Present constraints on an expansion of the research effort and means of overcoming them.

This paper addresses itself primarily to the first and last questions, by defining the problem of water management in the context of large societal problems, and by suggesting the elements of a planning strategy to intensify the focus of social science on the problem.

J.W. MacNeill,
Director,
Policy and Planning Branch

*W.R.D. Sewell, R.W. Judy and L. Ouellet, *Water Management Research: Social Science Priorities*, Ottawa, 1969. For a discussion of types of studies that have been undertaken, see W.R.D. Sewell and B.T. Bower, *Forecasting the Demand for Water*, Ottawa, 1968.

PRÉFACE

Ce mémoire est l'un des quatre exposés qui ont été rédigés à l'intention du Secrétariat des sciences du Conseil privé (Ottawa) afin d'examiner les besoins de développement et d'utilisation des sciences sociales dans la gestion des ressources en eau du Canada. Les autres mémoires traitent des rôles respectifs de la recherche économique, géographique, juridique et institutionnelle.* Les études devaient porter sur quatre questions:

- a) les principaux problèmes et aspects de la gestion des ressources en eau du Canada qui ont des implications économiques, sociales et politiques;
- b) le besoin de recherche en sciences sociales sous ce rapport;
- c) les recherches effectuées jusqu'ici et les priorités à accorder aux études futures;
- d) les contraintes actuelles imposées aux travaux de recherche et les façons de les surmonter.

Ce mémoire répond surtout à la première et à la dernière question, en définissant le problème de la gestion des eaux dans le contexte des vastes problèmes sociaux, et en suggérant les éléments d'un programme de planification visant à faire un meilleur usage des sciences sociales pour la solution du problème.

J.W. MacNeill,
Le Directeur,
Direction des politiques et
de la planification.

*W.R.D. Sewell, R.W. Judy et L. Ouellet, *Water Management Research: Social Science Priorities*, Ottawa, 1969. Pour un exposé des genres d'études qui ont été entreprises, voir l'étude de W.R.D. Sewell et B.T. Bower, *Forecasting the Demand for Water*, Ottawa, 1968.

FOREWORD

In this paper Professor Chevalier challenges Canadian social scientists and public policy makers concerned with planning to shift into the post-industrial era. The exciting ingredients and the vocabulary are there — the meta-problem; matrix organizations; systems analysis; the crucial role of knowledge, its stimulation, orientation and use; the need for flexible, incremental planning in a rapidly changing, turbulent environment; the need for integrity and strength in the social science and management systems combined with effective interaction between them; the primary and growing role of the state, organizationally adapted and functioning in a co-operative linkage with other large societal systems.

But he produces much more than ingredients and vocabulary. In addition to Professor Chevalier's penetrating theoretical insights he is always concerned with the application of social science to public issues. He challenges all of us to grapple with the problem of our water resources in its total social context and provides a frame and strategy appropriate to the nature of the problem, the scientific and management inputs actual and potential, and the adaptation needed in his two interacting management and social science systems. It is the general level of perception presented which is so badly needed in Canada. There is now a great deal of interaction between his two systems on a highly randomized, poorly articulated basis. If this provocative statement stimulates a debate at the same level of analysis by social scientists and managers it will have achieved a great deal.

The debate will revolve most usefully about the meta-problem as a valid concept, about calculability and incalculability as a planning premise and about the systems, their identity, their integrity and the notion of interpenetration.

Innovative thinking of this sort is altogether too rare in Canada, particularly in the areas of planning and public administration. In the past decade, Quebec social scientists have played a significant and far too unnoticed role in this kind of contribution. Processes such as *animation sociale*, the B.A.E.Q. development, systems and matrix organizational studies within the provincial government by Laval social scientists are all of this order. Compared with the more traditional exercises in the usual style of Canadian analysis typified by such efforts as the Glassco Commission, these efforts show far greater promise for a useful attack on our most important problems. They are of clear importance to the federal government, with its announced interests in such meta-problems as water pollution, bilingualism and biculturalism, urbanism, poverty and regionalism coupled with a strong commitment to public participation and to federalism.

Professor Chevalier's work is influenced primarily by his unique Canadian background and his experience in dealing with general meta-problems in Canada. To


this he has added social scientific perspectives from the United States and elsewhere. With this paper he demonstrates that he stands in the front ranks of the international social science community, particularly that part of the community involved in the study and development of planning.

January, 1969

Meyer Brownstone,
Department of Political Economy,
University of Toronto.

CONTENTS

	Page
Introduction	1
1 Changing patterns of organization	3
2 A new kind of problem	4
3 A basis for a general strategy	8
4 Organizations in two systems	11
5 A mechanism to link the two systems	12
6 An advisory panel on national water policy planning	16
7 Social science research for water management	19
Conclusion	23



Digitized by the Internet Archive
in 2023 with funding from
University of Toronto

<https://archive.org/details/31761116374562>

SOCIAL SCIENCE AND WATER MANAGEMENT: A PLANNING STRATEGY

Michel Chevalier assisted by Jeffrey Patterson*

Introduction

Canada possesses vast resources of water in comparison with many other countries. Yet Canada, no less than other countries, is faced with the need to properly manage her water resources. This paper deals with the development and application of social science with respect to water resources management in Canada.

The object is to define a general planning strategy for relating social science research to water resources management. Rather than a particular strategy, one applicable only in certain circumstances, this paper offers an underlying approach to the problem which may, in turn, act as a basis for more specific strategies.

There are a number of useful ways in which the over-all water problem can be broken down or classified into particular water problems. On this basis, it is possible to make a review of the kind of social science that would be immediately useful. In order to make a review in such a way that it can be used for decision-making in national, regional, and organizational contexts however, the water problem needs to be considered as only one of a set of major national problems. This is useful on the one hand because water management policies and actions relate in numerous ways to those of many other areas of concern. On the other hand, it is useful because some of the concepts and methods of social science applicable to water management can often be applied to the other problems.

In effect, the designation of the problem of water management as an area for social science research is quite arbitrary. Its boundaries are difficult to define with any rigour. The reason for designating water resources management for concern is an operational one. As is argued in Section 2, society perceives a group of interconnected problems as a single problem, and in consequence our administrative apparatus has been set up somewhat along functional lines, albeit overlapping many other problem areas. If the arduous research efforts undertaken by social scientists are not to be wastefully duplicated, this point must be borne in mind, and a strategy to deal with it developed.

Any review or classification of needed social science research should be expressed in terms common to many areas of endeavour. Furthermore, it must also be flexible and adaptable if it is to be useful to decision-makers in guiding the

*Institut d'Urbanisme, Université de Montréal.

application of social science knowledge. The last criterion is difficult to meet in that a review (and the required social science research it identifies and recommends) cannot be addressed to one or a few well-defined decision-making entities. Authority in water resource management in Canada has many sources. Even if there were a single focus, it would be appropriate to think of presenting a set of flexible recommendations that are neither "ideal" nor "comprehensive" in nature, but that are designed to encourage a pattern of responses which move in a desired direction rather than achieve a rigorously defined series of "rational" objectives. This is because the anticipated response of the decision-making entity(ies) to which the recommendations are addressed is at least of equal importance as the substance of the recommendations themselves. A lack of concern for, or knowledge of, the way in which their proposals can be applied is where many advisors and planners lose touch with reality. They identify themselves so much with the "answers" stemming from their investigations that they may forget the response potential of the decision centres concerned. In this case the task is difficult because the set of decision-makers in Canadian water resources management is large and disparate. There are a great number of organizations directly involved, and many more in other fields with some sort of critical stake in water resource decisions.

The difficulty of reviewing social science research accomplishments and needs in water management stems from the close but unclear relationships of water management with other functional areas of concern to society, as well as from the multiplicity of organizations involved in it. This difficulty can be overcome to a degree if the review is made in concert with a planning strategy.* A planning strategy may progressively relate, modify and extend such a classification because (as will be shown in greater detail below) only an incomplete inventory is possible at best.

Section 1 elaborates on some of the changing organizational aspects of contemporary society as they relate to the problem of water resources management.

In Section 2, we describe the characteristics of water resource problems in general and as they appear in Canada in particular. It is argued that the characteristics are such as to necessitate a strategy centred around organizations and the decision-making process.

In Section 3, the general strategy is described with the formal social science or water management organization as the decision-making unit.

Section 4 illustrates the kinds of organizations involved.

*A review of planning methods and strategies in relation to water management has been explicitly avoided. Rather, planning has been treated not as a social science discipline but as a process of marshalling and applying these disciplines and other areas of knowledge to the development of future states. Water resources planning must embrace all social science knowledge (together with other scientific, professional and technical areas of knowledge) which has either been applied or is applicable to water resources management. Any narrower field of concern is quite misleading; for example: a focus only on social science which has been applied to water resources management; or a focus based on a misuse of the global term, water resources planning, to designate particular combinations of knowledge application to the field – economics, sociology, geography, political science, law, hydrology, engineering, etc.

Section 5 describes the task-force approach as an example of how to intensify the development and use of social science for water management.

Section 6 suggests the use of a task-force for the development of a national water policy for Canada as a priority research concern.

Section 7 discusses some basic organizational aspects of social science research for Canadian water problems which can be clarified by the strategy.

1. Changing patterns of organization

The present era is characterized by what Gross (1) has called the "Administrative Revolution". An expanding technology underlies an increasing complexity of functions within society. The demands of society have become greater, and the resulting increasingly specialized division of administrative responsibilities has led to a proliferation of organizations, notably large-scale organizations, and also a greater dispersion of power within organizations as their functions become more complex. The revolution affects private and public administration alike, although the emphasis in this paper will be on the public sector.

As the total picture becomes more complex, so does the nature of the relationships existing among organizations. The result is a concomitant growth in the number and complexity of relationships among the functions which are the *raison d'être* of these organizations.

The respective but complementary roles of various kinds of institutions in organizing socio-economic affairs are beginning to be better understood — government agencies, universities, business concerns and research corporations, as well as combinations of these. The far-flung partnership of the National Aeronautics and Space Administration in the United States with space industry corporations is a case in point, particularly as the space industry is now turning its research experience to the solution of other national problems, notably environmental problems.

In endeavours such as this, business corporations are also combining their capabilities with those of universities. Partly as a result of this, the character of the university is changing rapidly, particularly the "multi-versity" which is linking itself in many new ways with organizations of many different kinds. The recasting of learning — education and research — as a central part of the whole socio-economic process is another recent phenomenon which is gathering momentum. This is reflected in such new developments as the establishment of "learning corporations" in the United States and the growth of direct participation by business firms of many kinds in providing knowledge resources to the educational system for teaching purposes. In turn, academicians are penetrating other organizations in a vast number of ways. Although the exact nature of the pattern of roles and relationships has not emerged, the general trend is clear: a growing interrelationship between organizations; this is bound to influence both the public and private sectors.

The trend is toward huge organizations interpenetrating each other in a vast number of ways, supporting a vast number of smaller specialized organizations and

special functions within larger organizations. It is toward a much greater emphasis on research, new information, many years lead time in new product design and market planning. It is toward a growing investment in learning not just by technologically oriented industries but by most organizations. The trend is toward functional networks which make sets of organizations highly interdependent in some respects and independent in others. The world air transportation industry is an example. And finally, the trend is toward organizations which take positive steps to initiate change in problem solving and adapt rapidly to the changing nature of problems, toward the merging of organizations, toward the initiation of new organizations for planned purposes and the sudden emergence of others to exploit incubator ideas, toward the establishment of countervailing organizations to trigger broader competition and deeper conflict, the closing down of sick or obsolete organizations. More and more this pattern can, in the view of many experienced observers, be expected to play on the world stage with entities of unprecedented size and relationships between them of great complexity and sophistication.

Parallel to this will be patterns of decentralization made possible by improved communication and manipulation of data, and possibly also greater understanding of interpersonal and intergroup relations. The field of initiative for specialist enterprises in knowledge, service or industrial production will continue to grow, with small organizations to complement the large ones.

We can conclude that the new scale of organizations and complexity of relationships between organizations will profoundly affect the definition of problems and the application of social science knowledge to their solution.

2. A new kind of problem

Associated with the changing patterns of organization is the emergence of an essentially new kind of problem demanding new approaches by the administrator. It arises from many and diverse causes; indeed, it may often be the result of certain desirable social gains. In spite of its diverse origins, a new problem of this nature is conceptualized as a single problem by society at large, though when it is examined in operational terms it is seen to be made up of a number of sub-problem areas. Finally, this kind of problem characteristically affects a multitude of individuals, organizations and interest groups. Indeed, it may affect almost every interest in the community, yet not be the primary interest or responsibility of any one major organization in the field of public administration. It is a problem which is typical of modern, functionally complex society.

The meta-problem

Meta-problems (2) emerge because of a society's (or a community's) expression of them. They are talked about, written and legislated about; politicians orate about them; government agencies are designated to deal with them and problems arise of co-ordination with other government agencies that deal less directly with them; resources are allocated and programs put in motion to meet them; and last but not least, social scientists are engaged to define them! A meta-problem is

usually characterized by the fact that the voices who usually speak for a society come (i) to perceive a set of related problems essentially as a single problem and (ii) to exhibit an obvious (although not necessarily common) concern about it.

Every major problem is complex in the sense that it is made up of a large number of elements. As Gross (3) says:

“What is the problem?” resolves itself into three closely related questions: Who is involved? What are their purposes? What is the blockage? In any complex situation, moreover, there are many different people with different purposes and different perceptions of blockage. This means that . . . all really important problems are *huge clusters of closely related problems*.

In the case of meta-problems, the perceived range of sub-problems is broad and the perceivers — individuals, groups and organizations of society — are many and varied.

The general acceptance in Canada of the notion of the “clustering” of societal problems into meta-problems is illustrated by two major conferences which have been organized recently by the federal and provincial governments. The topic of the first conference, a federal-provincial meeting in Ottawa sponsored by the Prime Minister’s Special Planning Secretariat in December 1965, was “poverty”. “Pollution” was the focus of the second conference, which was organized by the Canadian Council of Resource Ministers and held in Montreal in November, 1966. In the first case, problems of a poor physical environment, social deviance, sickness, unemployment, economic stagnation and low income were all considered as part of one meta-problem — poverty. Similarly, in the second case, air, water and soil contamination were viewed as overlapping and interrelated (not just additive) aspects of another meta-problem, environmental pollution. These and other clusters of problems or problem areas have come to be commonly perceived as single, massive problems in spite of their multi-faceted composition. Their complexity seems sometimes to drive society to perceiving meta-problems in huge, oversimplified fashion as vast challenges.

It is argued, however, that the meta-problem as defined here is more than just a large-scale problem and more than just a “cluster” of closely related problems. Both these features are part of the definition of a meta-problem, but the crucial point is the common perception of and universal concern for the vast range of interrelated problems that are subsumed in the meta-problem.

Gross (4) makes a useful distinction between aggregation of interests and integration of interests. The distinction is equally pertinent to the question of how the problems within a meta-problem “cluster” are related to each other. Are we to think simply about an *aggregation* of problems which are related simply in the sense that they centre around some more general area of concern? It is suggested here that a meta-problem is more than this. The meta-problem is not just an aggregation of problems, but an aggregation in which the lesser or sub-problems are perceived as being dynamically *integrated*.

The trend discernible in political articulation of certain kinds of problems, stimulated by the challenge of leadership and pressed by public demand, suggests an

informal recognition of this existence of an integration of elements. Great issues of current national concern – poverty, pollution, water management – are new not so much because of their substance as because of the way in which they are perceived. No longer is such a “big” problem dealt with as only a “basketful” of loosely related smaller problems, but rather as one comprehensive major problem, the meta-problem.

The administrator necessarily deals with cause-effect relationships. One intervention leads to another (or to a set of further interventions), and that to a further stage as initiatives are taken in response to various parts of a meta-problem. This presents a challenge of some complexity to the administrator. Not only must he deal with the set of sub-problems which are part of a meta-problem, like water resources management, but he must deal with the effects of initiatives taken in response to many other problems. Generally he cannot predict clearly and without ambiguity how all the elements are related and, therefore, what series of causes and effects are likely to be activated by any given initiative, either in his own problem area or in some other.

Calculability of problems

Every problem may be considered as having two dimensions, *calculable* and *incalculable*. Probably no problem can be characterized as purely calculable (except in an abstract, closed, and internally consistent system, such as mathematics); nor can a problem be characterized as completely incalculable. To the extent that the administrator conceives the relative dominance of either dimension, he should adapt his planning strategy to the situation as he sees it.*

Essentially calculable problems can be met in rational and deductive terms. A model of the problem can be constructed with a finite set of known elements linked together in an explicit fashion. One or more elements can then be varied and the effects traced throughout the model. The variation, or variations, that provide for an optimal solution to the problem can thus be identified either theoretically or by trial and error. The final step is implementation of the program derived in this manner.

For essentially incalculable problems the above strategy is less appropriate. The administrator may be faced with a situation in which either the goals cannot be precisely stated, or may not even be known at all, or a situation in which the cause-effect relationships linking events (and through which the administrator would hope to find a way to the goal) are too complex to be reduced to a model. This incalculable dimension of a problem may be due to either human or to technical causes.

Strategies for the resolution of essentially incalculable problems on the other hand, are basically adaptive and often incremental (5). Their interventions stimulate

*The factors motivating the administrator in defining a problem as calculable (or incalculable) depend largely on the kinds of problem-solving techniques he is accustomed to using. If, for example, he is more at home with objectives which are unambiguous, he will tend to define a problem as calculable, regardless of how its operational context corresponds to such a definition. And vice versa.

change in a desired direction rather than aiming to achieve a set of clearly defined objectives.

There is still another sense in which problems may be said to have an incalculable dimension, and it is in this respect that the meta-problem can be most clearly distinguished from other problems.

It was stated earlier that the meta-problem occurs as the result of many different and related causes, that it affects a wide segment of the community, and that although it comes to be thought of (quite legitimately) as a single great problem, still the issues associated with it cannot be resolved by any one organization. Simply because it is the product of a functionally complex society, solution of the problem depends first, on the acceptance by a wide diversity of organizations (and unorganized interest groups and individuals)* that a problem exists and that it is in the interest of those organizations to address themselves to its solution; second, on co-operation and action by those organizations; and third, on the efficient co-ordination of their individual efforts. The need for co-ordination means a concern for the interfaces that exist between organizations, and these promise to become even more a part of the picture of the meta-problem as our perception of multi-dimensional, cause-effect relationships sharpens and our ability to identify them improves. This necessary dependence on the support of such a diversity of people and organizations over whom the administrator exercises no direct power (though sanctions with varying degrees of effectiveness may exist) makes the incalculable element ever-present, if not predominant, in the administrator's thinking.

Canada's water problem

Implicit in the task of compiling an inventory of needed social science research in relation to water resource management is an assumption that the inclusion of a greater range of variables in management decisions could result in improvement of the quality of these decisions. This means that society perceives that past water resource decisions, by being based too narrowly, were not as advantageous to society as they might have been had the knowledge, techniques and methods of social science played a larger role. Stimulation of new knowledge by social science research is also implied.

Water resources management in Canada can be classed as a meta-problem. It is made up of a great many problems which have come to be perceived as one large problem. It is incalculable in that it overlaps with other meta-problems (for example, with those of poverty and pollution as indicated above). And it is the concern of a great number of individuals, interest groups, and formal organizations in the public and private sectors.

An additional aspect to the water problem intensifies its incalculable aspects. This is a condition peculiar in several ways to Canada. It is the problem presented by the relative abundance of water resources, nearly forty per cent of the total world supply of fresh water.

*Organizations are given primary consideration because they represent in the main the operational decision-and commitment-making capability of society.

The problem then becomes one of the exploitation of various water-resource opportunities and deciding among the comparative advantages of competing opportunities (6). This is a problem vastly different from that encountered in most other countries.* Because they are not compelling, choices among opportunities can increase the difficulty of goal formulation. Theobald (7) and others maintain that the abundance of opportunities for action in an affluent society cuts down the compelling aspects of problem solving and makes the initiation of action in the public sector without the inducement of public demand all the more critical.

Our task is to formulate a strategy which can review existing and needed social science knowledge for application to the incalculable problem of water management, particularly in the Canadian context of the challenges presented by abundance.

3. A basis for a general strategy

As water management is primarily the responsibility of public administrators, we have assigned the main management role in the following discussion to government departments and agencies.

By and large, the public administrator identifies himself with his agency, and he is concerned with its stability, procedures and informal goals, as well as with its formal goals. The intensified application and stimulation of new knowledge in social science is not one of his major preoccupations *per se* (8).

On the other hand, the social scientist (and social science, particularly in its "pure" form) is scarcely concerned with the operational problems peculiar to water management except in a remote and theoretical way. When he examines the problem area, he tends to do so in terms of his own particular specialized scientific constructs — constructs designed for theoretical argument more than for operational use. Moreover, when he wants to test his constructs, the social scientist is by nature in a position to choose among a number of meta-problems, although there may be some practical limits to his choice.

There is normally no compelling joint interest which draws the public administrator in water resources to the social scientist or vice versa, although there appears to be a growing willingness on the part of society to invest in a closer relationship between the two. Society perceives a meta-problem here. Society sees inadequacies in present policies of water management and senses lost opportunities, that is to say preferable alternative allocations of resources. Of course, social science has long been applied to water resources management, but there is apparently a new sense of urgency for an intensified contribution. The contribution is not seen as just more of the same, but a contribution at an altogether different level. This level is the meta-problem level.

The formation of the Water Group and its Policy and Planning Branch in the Department of Energy, Mines and Resources, and the interest of the Science Secretariat in Ottawa, together with other emerging specialist agencies at the federal

*Even in the United States, the problem is mainly to meet already evident new and remedial demands. There are, of course, numerous problems of this nature in Canada also.

and provincial level, all give evidence of a growing readiness by governmental organizations to make wider use of relevant knowledge — including social science — in this field of policy. Thus, the initiative lies with agencies such as these. It is on them that new demands are being focussed in regard to water management; it is much less on social scientists and social science organizations.

There appears to be an emerging common goal between water managers and social scientists. On the one hand, an intensified application of social science can help the public administrator in a water management task which is seen to be beyond the capability of present administrative processes; and on the other, there can be a stimulation to social science through its intensified application in a meta-problem of such wide scope.*

Two systems

A useful perspective for the required kind of general strategy discussed in the Introduction may be achieved by defining social science and water management as two distinct systems of activity. A two rather than a three or more systems model is selected to provide a simple binary classification of relationships for action and evaluation. Each system interpenetrates with the other and with other systems. Each system has its own sub-systems within it. The two systems and their interrelationship are, of course, nothing more than an analytic construct upon which to base the strategy. A *system*, as the term is used here, is “a boundary-maintaining set of inter-dependent particles or sub-units. . . . By inter-dependence is meant that whatever happens to one component of a system affects, no matter how slightly, the balance and relationships of the whole system. By boundary [it is meant] that the components are so related that it is possible to ascertain where the system ends and the environment begins”(9).

Each system is made up of and defined by its units or sub-systems; these sub-systems are defined as formal organizations. One system is made up of organizations (or units thereof) whose primary role, is in social science research. The other system is made up of organizations whose primary role is in water management. If an organization has a primary role in both systems, the sub-organizations concerned may be assigned to their appropriate system.

The organizations are *necessarily* the same as others in their system in only one respect; that is, they have a role in either water management or the development of social science.

The selection of formal organizations as the elements of our two-system strategy is made on the premise that decisions — in this case commitments or noncommitments for the application of social science knowledge — are made in an organizational context. The organization is the decision-centre. Of course, this is no more than a reasonable operational approximation of the decision-making process.

*Of course, there is an optimal range at some level beyond which there is the danger of a “social science knowledge” overload for the administrator and an “applied” overload for the social scientist. It is generally accepted that that range has not begun to be reached in the case of water resources management.

The strategy possesses the merit of simplicity, and serves our purposes adequately because of its characteristics of incrementalism and successive approximation.

The strategy is based on the interests of each organization because organizations are defined as interest groups. To quote Gross(10):

Although satisfying human interests is the *raison d'être* of any organization, interest satisfaction objectives are the hardest to formulate. There are many different "interesteds" both inside and outside an organization. Their interests are usually multiple, often hard to identify, always divergent, and sometimes sharply conflicting. Creative managers may promote new interests and aggregate or integrate existing ones into broader common interests. Yet common and public interests are also multiple, divergent and changing.

The strategy recognizes both the formal and informal dimensions of organizations. The "multiple, divergent and changing" interests will be looked at in these two dimensions. Broadly speaking, the formal dimension reflects the stated or official interests of the organization, and the informal reflects its unstated interests (for example, in survival) or those of particular groups within the organization. The organizations themselves are defined as interest groups, and their interests are defined as they relate to each of the two systems.

The organizations are considered here insofar as they interact with other organizations in their system, and as they provide for interpenetration between systems by interacting with organizations in the other system. The strategy becomes one of stimulating the interpenetration of organizations, especially across the boundary separating the two systems – in effect an induced development of social science knowledge for water resources management.

It was noted above that water management and social science as areas of activity (systems) have not in the past been closely related to one another. Their relationships are still haphazard and are not of any great intensity. The strategy aims to intensify the number and nature of organizational interpenetrations to make each system more *salient* to the other.

An objective of the stimulation of this interaction is a more capable water management system as the quality of decisions made by its organizations is improved by social science knowledge. A secondary objective is a more capable social science system as its organizations learn how better to apply its knowledge to problem-solving situations.

In summary, we have defined two systems – the water resources management system and the social science system – the organizations belonging to each one, and the phenomenon of interpenetration of organizations between the two systems. We have noted that the systems are not inherently salient to each other, and that greater salience between them requires stimulation. This is where the strategy proposed in this paper comes in. It is designed precisely to stimulate greater salience – to build bridges – between the world of water resources management and the world of social science.*

*Section 4 describes the nature of the organizations in each system, and Section 5 illustrates a method of interpenetration.

Initiative may often have to be taken in an adaptive, incremental and even disjointed manner, particularly at the present stage of relative lack of salience between the systems. This is because of the complexity of the problem and the great number of decision centres (organizations) involved. The ideal of the "rational" and comprehensive program to meet a set of clearly defined objectives does not apply here, as the problem is an incalculable one.

Organizations must make the formal moves. Often these moves are best initiated by organizations in the water management system rather than organizations in the social science system. And public agencies are well-suited to take the lead. They have the primary roles and responsibilities for coping with this meta-problem.

4. Organizations in two systems

Organizations of each system will have varying characteristics. They can be public or private, single or multi-purpose, independent or part of a larger organization.

In the water management system public agencies can be considered as having some combination of policy, regulatory, and operational concerns. Examples are:

- (a) Science Secretariat (Privy Council)
- (b) Policy and Planning Branch of the Water Sector (Energy, Mines and Resources)
- (c) Ontario Water Resources Commission
- (d) St. Lawrence Seaway Authority

Examples (a) and (b) are primarily policy-oriented, (a) with a broad societal orientation and (b) primarily concerned with water resources. Example (c) is largely regulatory, with some policy and operational concerns. Example (d) is primarily operational with few policy and regulatory responsibilities.

Organizations in the social science system are considered as having some combination of teaching and research concerns. As most Canadian social science research is done in universities, university teaching departments, or university-controlled or affiliated research institutes, organizations will be found primarily in the university and the university-related environment. The extent to which social science research activity supports teaching as opposed to research *per se* will usually be reflected in the nature of the particular organization (university, teaching department, or research institute).

These are merely illustrations of the diversity of concerns of organizations in each system. Even those organizations whose primary role is in water management or social science have formal interests which link them with other organizations far beyond their system. This is, of course, in addition to their informal interests (in survival and growth, for example) and those of their members, which affect the way they pursue their formal interests, and also often link them with organizations in different fields.

In effect, the many factors which govern the decisions of organizations in either system dictate that they can respond to a review or inventory of water research

needs only in a peripheral way. Rapidly changing perspectives of specific concern to them, factors of urgency and bias, availability of funds and talent, can make their response to it no more than a partial and disjointed one at best.

Opportunities for the development of mutually supporting activities in either of the two systems defined for our strategy are diverse and disparate; they do not fall within the scope or interest of a few easily identified organizations. In the face of this, an incremental and adaptive approach is required, to meet a goal of direction rather than of substance, an intensified interaction between the two systems.

Interpenetration between the water management and social science systems calls for action in one system on the part of an organization from the other system. Each initiative must be considered and evaluated on its own merits, if possible within guidelines or a unifying frame of reference.* It can take the form of funding of water research by a water management organization, for example, or undertaking of water research by a social science organization. Interpenetration from one system to the other can also be made by individuals or unorganized groups. But organizational interpenetration is stressed here as a strategic prerequisite for significant individual interpenetration because organizational commitment provides the basis for continuity and expanding activity.

There can also be co-operative interpenetration by a number of organizations for a single purpose or project. Such a commitment on the part of a number of water management agencies, for example, at the project's research phase (and possibly including related public agencies as well), may serve as a basis for co-ordination in policy planning and execution later. The nature of organizational participation in a research project can be critical in developing continuity and momentum in the stimulation and use of social science research in the problem of water resources management.

We have discussed here the stimulation of interaction between the two systems within the structures of organizations. In Section 5, we turn to a possible inter-system activity which we believe should be central to any program of meeting social science research needs for water management.

5. A mechanism to link the two systems

The task force concept has already been quite widely discussed in the organizational literature. For instance, Bennis (11) gives us the following prediction about the expanded role of the task force in the organizations of tomorrow:

The social structure of organizations of the future will have some unique characteristics. The key word will be "temporary"; there will be adaptive, rapidly changing *temporary systems*. These will be "task forces" organized around problems-to-be-solved.

Bennis proceeds to describe the nature of the task force and the role of its members. In the future, problems are likely to be solved by groups of relative strangers (in the sense of not being members of the same organization) who

*A set of guidelines is put forward in Section 7.

represent a set of diverse professional skills. The groups will be arranged on organic rather than mechanical models; that is, they will evolve in direct response to a problem rather than in response to deliberately programmed role expectations.

While we may not agree entirely with the radical evolution of the bureaucratic structure which Bennis predicts, there is perhaps some utility in his prophetic statements regarding the extension of the task force.* Wilensky (12) expresses a similar view when he advocates the use of a task force as a device to incorporate specialist knowledge into the decision-making apparatus. He praises it for being flexible and informal as well as for enhancing the performance of individual participants. Furthermore the task force mechanism has a utility for communicating information among participants and out to organizations.

The task force, depending on various factors such as its scope and purpose, will recruit participants from different knowledge areas and from different organizations in both of our systems. There are here potential linkages among various knowledge areas, and also among various organizations. Ideally, the task force becomes an entity or actor in its own right; then the linkage between elements of the two systems, has taken place. Loomis (13) discusses the notion of a systemic linkage as follows:

[it] can be defined as the process whereby the elements of a least two social systems come to be articulated so that in some ways they function as a unitary system.

Two other actors (or classes of actor) are the social scientist and the water manager as a reflection of the water management or social science organization (14). (One could also divide these classes of actor into sub-classes; for example, the water manager could be from either a private or public sector organization.)

The water manager is preoccupied with the practical constraints of the particular problem area facing him. These include the innumerable variables which make up its environment, particularly in the form of the process of allocation of values between this and the other demands of society. His posture is (ideally) flexible, pragmatic, and incremental.

The task force, too, is preoccupied with the problem area, but it takes a more comprehensive view. Its perception is less constrained by operating requirements. Although the task force will take these into account, it will not be influenced by them as acutely as the water manager, who is directly affected by them.

*The task force is only one of many mechanisms for harnessing the resources of two or more organizations (or the knowledge of a number of disciplines and professions) to a particular purpose. Advisory Committees, agreed procedures, regulations, coercion and bargaining, contractual arrangements, various modes and patterns of communication, norms and societal values, etc., or combinations of these, all play a role. The task force is selected here as an appropriate kind of mechanism to stimulate interpenetration between our two systems, to invent and induce initiatives, and to scan the over-all problem when evaluating these initiatives and relating them together. Task forces can be set up under various organizational auspices and for various purposes within the wide context of our problem. An illustration in the form of an advisory panel for developing a national water policy is discussed in Section 6.

The social scientist is less preoccupied with the problem area as such. He will tend to consider it in the context of his particular discipline and be less concerned about how his discipline might help solve the problem. This is a phenomenon which Abraham Kaplan (15) calls the "Law of the Instrument". He notes that it is by no means wholly pernicious. It is after all quite proper for a social scientist to propound and employ his own methods. However, when a problem is larger in scope than the perspective of a particular social scientist or discipline, the phenomenon may be dysfunctional.

How does one co-ordinate and evaluate the feeding of knowledge from its many social-science sources through the planning and decision-making process to the execution of a program in a particular problem area? The task force must have a sufficiently broad perspective to encompass the problem, certainly much broader than that of the water managers or social scientists.

Again, let us return to the composition of the task force. Do we bring together a group of social scientists all in the same field of specialization, let us say, resource economists? or is an interdisciplinary group the best answer? or should there be an additional mix of planners and executives? and how big should the group be? what organizations should the members of the task force come from? and so on.

There are guidelines to ways of getting a task force underway, of monitoring and evaluating the resulting process, and of making changes in consequence (incremental or otherwise). First of all, each of the three described above – the water manager, the task force, and the social scientist – can be said to embody a distinct kind of view of the problem of water management. And the task force view can develop in various ways depending on its task and makeup. Small group (16) research in sociology and social psychology will give us some of the guidelines we require (17).

The various networks established by the group will provide various kinds and intensities of feed-in to and feed-back from the central group. The concept of the communication network corresponds to the kind of relationship a water manager might develop with the other participants in a task force. Will they be encouraged to interact? and if so, how? will sub-groups be established? and so on. The simple concept described here can be developed to more complex levels for specific purposes.

There are various other concepts in small group research which may be able to provide insights into the setting up and operation of a task force: the notion of guidance and initiative and its relation to being liked (the task leader as opposed to the social-emotional leader) (18); the effects of cohesiveness on influence and productivity (19); and styles of leadership (authoritarian versus democratic) (20). These are but a few examples.

Such hypotheses are in the main drawn from specific experiments. They do not provide any hard and fast rules for practical application. They do, however, give insights or guidelines to help set up, operate and observe the output of a task force.

The water manager must feed knowledge into his strategy in such a form as to meet its "remedial, serial, and fragmented attributes" (21). But the social scientist is often prone to create his knowledge "packages" as comprehensive entities. These

packages possess the additional drawbacks of being largely insulated from the packages of other disciplines, and of having been prepared with only secondary concern for the water manager's central preoccupation — that of meeting the infinity of variables of his "open" problem.

The makeup and relationships among individual members of the task force must provide the manager with a means to synthesize the knowledge of the social scientist from its various disciplinary sources. The task force should permit the manager to guide the configuration of the packages that are presented to him. He can thus avoid having somebody else's comprehensive plan or scientific construct thrust upon him with the corresponding negative influence on his own commitment to it, which is a pretty important factor after all! All he can do when these are imposed upon him is to extract pieces of them for a ponderous and time-consuming resynthesis, or to ignore them altogether. This is one reason why such a small part of the available social science knowledge is actually applied in the field today.

To sum up, the individual manager's tactic in applying social science is one of experiment and increment, and the task force should operate so as to provide knowledge in a form to meet such tactical requirements.

A task force of the kind described here may be adopted by a number of government agencies. It is visualized as being temporary and *ad hoc* but with a number of full-time participants while it is operating. To begin, possibly no more than one agency should undergo the experience, an experiment carefully set up and evaluated on a scientific basis. Once lodged in a number of agencies (maybe two or three in Ottawa, and a few more at the provincial level), the variety of initiatives or events generated by each task force could lead to a form of interaction among the task forces which in turn could develop in a further direction the momentum of interpenetration between the two systems which we have been seeking. Such a network of interorganizational task forces could be focussed on a single meta-problem, but could also be made to interact with task forces for other related meta-problems. A network of this scope would correspond in some respects to a multi-dimensional matrix organization. This form of cross-functional liaison mechanism used in industry, primarily the aero-space industry, is only two dimensional in that it links functional responsibility to task responsibility.

To sum up, there are good arguments for setting in motion a number of experimental *ad hoc* task forces in selected public agencies in the water management field at the federal and provincial levels of government. An exercise of this nature would be a social science research effort in itself of significance in two ways: firstly, it would help clarify planning and co-ordination procedures within the public service itself; secondly, it would be developing knowledge about the relationships of organizations in the public sector with others in the private sector as focussed together on a large problem.

Both of these steps are of vital concern to increasing the effectiveness of water resources planning and management. It might not be too much to suggest that without some major advances on these two fronts, the depth and sophistication of social science, even as it now stands, cannot begin to be applied to the problem except in the present fragmented and haphazard manner. This means that the

further development of social science knowledge in respect to the problem may have a greater or lesser measure of irrelevance *per se*. The first priority may be that the water management apparatus, notably in the public sector, must be modified so as to make it possible for it to use and help develop social science research for its purposes.

Finally, it is appropriate to consider the task force as a mechanism to stimulate interpenetration of organizations between the water management and social science systems, which is the first concern of our strategy. The task force, with its comparatively broad perspective and interest, would be charged with inventing and inducing intersystem research and applied initiatives, evaluating them, and scanning the over-all problem area to relate them together so as to stimulate a new round of initiatives.

6. An advisory panel on national water policy planning

The need for clearer definitions of national water policy has been brought home to the Canadian public, polity and bureaucracy as a result of such episodes as the lengthy planning and negotiation process for the joint United States-Canada use of the Columbia River. National awareness was probably stimulated even more by the recent water crisis in the Great Lakes-St. Lawrence River Basin when water quality and other water management problems persisted in the public mind even as the immediate crisis receded. Other lesser, but still acute, water problems emerging across the country have also awakened public opinion, as have the much more far-reaching problems affecting large areas of the United States. So Canada is now more than ever aware of a national water problem. And the appropriate response is agreed to be the development of a national water policy.

This raises a number of questions. For example: How will policy be developed to reflect interprovincial and federal-provincial powers and responsibilities? What will be the nature and degree of continental planning and action? What will be the interface with related problem areas such as physical and economic development, and less closely related areas such as education and welfare? What revisions in the legal-bureaucratic structure will be made? And what means will be taken to apply and extend knowledge to better define and execute the policy?

Questions of this nature will be asked continuously. Definite answers cannot be given to any of them, but they can be progressively and systematically clarified. We will treat the articulation of national water policy as being an essentially incalculable problem, and justify this treatment for the reasons put forward earlier in the case of the broader, over-all concern of the management of Canada's water resources.

National water policy planning is first of all a responsibility of the Policy and Planning Branch of the Water Group of the Federal Department of Energy, Mines and Resources. But the Federal Government itself and other federal agencies and provincial governments and many of their agencies, as well as a great number of organizations in the private sector, have a stake and a role to play.

In addition to the required involvement of all these organizations and the continuing process of reconciliation of their interests, national water policy

planning requires a continuing input of knowledge from the social and natural science disciplines, the professions, and from other knowledge areas. In principle, the whole field of human knowledge is applicable to a planning process as broad as that of Canada's national water policy, but in practice, of course, this is only attainable on the basis of scanning and selection.

If the relevant aspects of national water policy are as broad as has been defined above (and the argument of this paper suggests that they are), then one cannot think of *a* national water policy which is more or less clearly established as to substantive objectives. Despite the fact that a number of Canadian leaders have called for this form of clear-cut policy in recent years, it appears to be quite impossible to achieve without simplifying the issues by assuming away many critical questions such as the ones enumerated at the beginning of this section.

A more promising working alternative appears to be to aim for a *continuing process of planning* national water policy rather than *a* national water policy. Rather than aiming for a set of specific objectives or criteria as one would be inclined to do with a calculable problem, one is forced to think more in terms of working within a defined yet adaptive frame of reference. Purely by way of illustration, such a frame of reference might be defined to include the following (by no means exhaustive) elements:

1. Because of Canada's vast water resources, to search out opportunities rather than confine the country to a remedial or demand satisfying posture. (There is some general confusion, and public agencies often display ambivalence, about this issue in Canada.)
2. Develop a clearly accepted national water policy role relative to provincial jurisdictions and a clearly established process of consultation and joint planning with provincial agencies prior to establishing federal policies on matters of joint federal-provincial concern. (There are some precedents on this aspect, in federal-provincial fiscal relations, for example.)
3. Make a clear and detailed commitment to undertake water policy planning in relation to all other national meta-problems which affect water management. (This is only done in a haphazard and fragmented way at present, because the style and institutional makeup of the Public Service are only in the first stages of adaptation to this recently perceived requirement.)
4. Make a similar commitment to stimulate the development and use of scientific and practical knowledge for national water policy planning. (Such a commitment is already reflected in the terms of reference of the assignment of which this paper is a part.)

Again, it is stated that the above aspects of a frame of reference for national water policy planning are merely illustrative. To have any operational meaning, a great deal of work must be done on them. But such aspects or elements provide a direction for planning which is not clearly apparent at present. What kinds of public service mechanism can begin to chart directions of this kind more clearly?

A modified form of the task force is proposed. It is an *ad hoc* advisory water policy planning panel attached to the Policy and Planning Branch of the Federal Energy, Mines and Resources Department. It should consist of a small group of individuals drawn from the sciences as well as from various public agencies and private organizations concerned with water management. Panelists would be appointed full-time for varying periods of months or years in such a way as to assure a progressive turnover of personnel. The purpose of this form of full-time appointment is to establish the panelists' identification with the panel and its purposes, while assuring at the same time that they maintain to some extent an identification with their previous roles (22). A government agency advisory group which is full-time but where regular turnover is not encouraged, or one which is only part time or voluntary and occasional does not create the necessary dual (or multiple) identification on the part of its members.*

The need for this dual (or multiple) identification is illustrated by an approach which regards

the researcher as a member *pro tem* of a third organization [as distinct from a research or operational organization] sufficiently greater than the [operational] organization under study to encompass the conflicting interests and yet sufficiently close to it to permit its values to be related to the concrete issues

Ideally this third organization would be sufficiently broad to encompass also the interests and values of the research community (23).

The role of the advisory panel would be to advise the Policy and Planning Branch of Energy, Mines and Resources (or the Minister) in the water policy planning process. The panel would be a loosely structured group internally, permitting assignments to be made to one, a few, or all panelists. The task force characteristic of a broad perspective would be required of the panel, although its makeup could also reflect some of the more immediate concerns of the planning process. The panel would not be directly charged with policy planning and evaluation, which would remain the job of Branch staff. The panel would be solely an interface mechanism to study and recommend planning and evaluation inputs from various organizations and knowledge areas. It would consider the established water policy elements, such as the ones put forward for illustrative purposes above, and suggest inputs to clarify particular problems relating to them. These inputs might be in the form of research projects, operational planning exercises, or policy proposals.

For example, the first policy element suggests an opportunity as opposed to a remedial or "satisficing" planning posture. The advisability of water export can be considered in that context. In some respects, the governing factor (at least politically) is the very real but diffuse one of Canadian sovereignty. Obviously this is

*The Advisory Group of Central Housing and Mortgage Corporation is an example of the first kind, the Canadian Council on Rural Development of the second.

a subject for social science research. It needs clarification in the political as well as the legal, economic, social, and cultural sense. This concern goes far beyond the concerns of water management, but is essential to it. The advisory panel would scan the whole field of social science by interview, meetings, literature search; it would review its findings among its members; it would pass on these findings with the individual comments of its members to the Branch; and it would recommend further research.

Another example can be drawn from the fourth among the water policy elements put forward above. The development and use of knowledge as a whole for water resources management is the committed direction of this element. The panel could play a unique role here because of its task force makeup and advisory policy-making assignment. It could play this role in collaboration with the other institutional mechanisms involved, including the Policy and Planning Branch itself, and the National Advisory Committee on Water Resources Research. The advisory panel would be able to bring to bear its task force characteristics in furthering the two systems strategy for the development and use of social science (as well as other) knowledge.

Finally, the advisory panel might be set up initially as a social science action research project to evaluate the applicability of the task force mechanism as an aid to policy planning for the incalculable problem of water resources management in Canada.

7. Social science research for water management

This paper is concerned with the development and use of social science research for water management, not with social science or with water management *per se*. Rather the goal is an intensification of the relationships between them. To clarify this goal, we defined the two systems — the social science research system and the water resources management system* — and their elements in the form of organizations. To simplify discussion in this section, social science organizations will be equated with university or university related organizations, because universities do most of the social science research in Canada; and public agencies will be the ones of primary concern in the WRM system, because they, much more than private water management organizations, are the ones with the broad policy view which is the focus here.

Two goal aspects

Two aspects of the goal of intensified relationships between the systems are of particular relevance. *One*, the strengthening of the SSR system which is reflected in the process values of research, as opposed to the product values. The process values give priority to the strengthening of social science research in itself, and are the primary concern of social science research organizations. Product values have to do

*Hereinafter the SSR and WRM systems.

with the specific problem solving concerns of water management organizations. The process values (24) should generally have precedence in meeting our goal of intensification of relationships between the two systems – that is to improve the capability of the SSR system to interface with the WRM system. Product values might generally best be met with in-house applied social science research by water management organizations, while social science organizations (or universities) should be primarily responsible for process value research which strengthens their capabilities. *Two*, the strengthening of or modification of organizations in the WRM system to make them better able to use social science research.* A set of public agency task forces was put forward earlier as an example of a modification which could usefully be tested. Process values in this case reflect the incremental changes or modifications in the water management institutional structure, and product values the carrying out of tasks and functions; process values take precedence here also.**

To sum up, the two goal aspects are a strengthening of the capability of the social science research system to provide knowledge to the water management system, coupled with a strengthening of the capability of the water management system to make use of it.

Three kinds of interpenetration

There are three main kinds of organizational interpenetration between our two systems:

- (1) Interpenetration of water management organizations to the SSR system – support or commissioning of research activity;
- (2) Interpenetration of social science research organizations to the WRM system – the carrying out of social science research relevant to water management;
- (3) Joint interpenetration comprising a combination of applied research and management – the application of social science research in water management settings (25).

One might also think in terms of three stages of interpenetration:

1. WRM \rightarrow SSR
2. WRM \leftarrow SSR
3. WRM \rightleftharpoons SSR

We will select the first as the initiating stage, although in practice the process will be less orderly than that; but at least as regards commitment to the

*In that connection, it is assumed that the increasing capability of water management organizations to support new (and relevant) research tends to be dependent on their ability to use research.

**On the other hand, for both the first and second goal aspects one might choose to give precedence to product values for any number of reasons, such as pressing short-term requirements. The strategy can do no more than encourage a systematic weighing of alternatives. To simplify the argument here, general precedence is given to process values.

meta-problem, it is often the water management organization which must take the initiative. The water manager can make decisions by projecting his initiatives through the three stages and, of course, by relating them to other research initiatives. And he can keep before him the two goal aspects described above in assessing the probable effects of his initiatives.

The organization of research

The precedence given to process values for research in the SSR system and for organizational change in the WRM system will affect the organizational as well as the substantive makeup of social science research and how it is later evaluated and applied to the WRM system. There are many alternatives, for example, individual projects as opposed to programs over several years, and teaching departments as opposed to research institutes. It will also affect the teaching-research mix, a specific water management as opposed to a more general research focus, and so on.

The question of multi-disciplinary research and how to stimulate it is critical to a meta-problem such as water resources management. To answer the needs of the two goal aspects, when should a project be large or small? Should one think in terms of a water research institute? Should an approach of post-research interface evaluation of projects as to relationships with other social science research be considered or should the more generally accepted approach of organizing multi-disciplinary research beforehand be given precedence, or both? To what extent and how should research be synthesized as it is applied to the water management process? Can the task force mechanism be useful in that respect? *

The advisability of supporting the establishment of a set of water research institutes at strategic university locations across the country is an example which can be considered in the context of the three stages and two goal aspects described above. This approach can help stimulate the three stages of interpenetration between the systems, and of particular importance, the third stage of joint interpenetration; or it can develop overly exclusive characteristics to inhibit the third stage. The specialized institute approach might have process value for the goal aspects of the SSR and WRM systems from the standpoint of continuity, but it also might degenerate into a product-oriented exercise in both respects. The organizational makeup and perspective at the water management end of the relationship is, of course, also critical. The nature and quality of research and the institutional arrangements obtaining will govern the result in each case, but the goal aspects and stages of interpenetration can help in decisions about the substance, organization, and application of research initiatives. Are such initiatives meeting the two goal aspects? How are they proceeding through the three stages?

An illustration

The sequence of three stages of interpenetration begins with the problems of the water manager, applies social science to them, feeds back the results to the social scientist, and finally stimulates a continuing interaction between the two

*This relates also to public and private sources of funding other than WRM.

systems. To indicate how this can help define appropriate university research mechanisms, a priority water management problem is chosen, say that of over-all water use planning of river basins. A problem of this order is chosen, because problems at such a scale are becoming more critical as elements of the meta-problem, and they also create unresolved difficulties in organization at all of the three stages of research, application and feedback.

The problem is common to both the WRM and SSR systems. It is one that is faced by water managers almost everywhere. And its scope and nature is similar to many other meta-problems (or meta-problem elements) in other fields of concern to the social scientist.

Should a permanent water resources research institute be assigned the mission of bringing together the technical and social knowledge relevant to this problem? It depends. There is a great wealth of existing knowledge to be marshalled here; in the technical sense the uses of the water resource, its preservation and control, its spatial and physical relationships to human settlement; and in the social sense, human and social relationships to the resource, social organization for its management, ways to apply the research results. And so on. And there is, of course, new knowledge to be found.

Any research institute necessarily has some kind of bias. What is it in our hypothetical case? Is its orientation basically technical? Social? Is there a well-organized tension between both orientations? Is the institute biased toward particular disciplines or technologies?

Two main questions stem from these queries. Can the institute's bias be rebalanced temporarily to permit it to fully address itself to our problem? Does the institute have a formalized concern and a capability of translating the results of research into a form where action can be taken, and of collaborating with a water management organization to that end?

If queries such as those above can be clarified, and the two main questions can be answered in the affirmative, an institute is ready to take on a research mission for a problem on a scale of the one put forward here. If not, the institute might best restrict itself to solving smaller scale problems, which although undoubtedly of value, is scarcely a response to the meta-problem.

There are indications that few university research institutes can clearly answer both of the main questions in the affirmative. For example, their indifferent record of applying research to large social problems in the related field of urban studies where there has been a great deal more research activity than in water resources, gives evidence of this.

Should one consider establishing a set of water research institutes across Canada as the basis of a national research effort? On the contrary, it would appear that a more tentative, flexible approach is required. The main national (provincial or regional) approach might, for example, be toward a series of temporary university research programs to carry out definite missions for selected large scale priority problems stemming from the meta-problem of water resources management. The social science capabilities assembled for these programs would be governed by the nature of the problem. Established research institutes need not be excluded from

carrying out missions, but generally should not be set up for the purpose. Furthermore, they are probably inappropriate as the main kind of mechanism to carry out such a series of missions. A few of the research programs set up temporarily in this way might evolve into permanent water research institutes capable of responding to the meta-problem if a dual capacity can be built into them to handle research for large water problems as well as to collaborate with water management organizations in applying and evaluating its results.

The above illustration takes account of the process research values and the interaction required to strengthen both the WRM and SSR systems on a continuing basis, thereby continually improving the capacity of each to contribute to the other. This recognizes an interdependence between knowledge and planned action on a large scale, which is basic to any over-all response to the meta-problem.

To sum up, the two systems (WRM and SSR) and the two goal aspects and three stages of interpenetration, which have been defined to achieve the over-all goal of intensified relationships between the systems, represent a common strategy for patterning decisions among many organizations and for evaluating their results in a related manner. In addition, the strategy aims to explicate factors which are accepted as implicit but are now taken only haphazardly into account.

Conclusion

We have considered changing organizational patterns generally and the growing complexity at the interfaces between organizations.

The emerging phenomenon of the meta-problem has been described, encompassing many smaller problems and the interests of many organizations. But because it has been perceived as such by society, it requires an over-all response. The problem of water resources management in Canada is such a problem.

The idea of the calculable or the incalculable problem has been put forward. Water resources management has been defined as an incalculable problem, and the elements of an over-all total strategy for the use and development of social science in response to it were cited — a combined process of incremental steps and scanning within a total frame of reference. Goals of direction for the incalculable problem were shown to be appropriate rather than the clear unambiguous goals typical of the calculable problem.

A two-system strategy was proposed. The strategy focusses on the relationships between the water resources management system and the social science research system, as represented by the activities of organizations across system boundaries. These activities are described as interpenetrations.

The task force mechanism illustrates that organizational change in the water resources management system is a prerequisite to the development of the strategy. A specific example of a task force role in national water policy formation is given.

The goal of direction defined for the strategy is an intensification of the relationships between the two systems. The two aspects of this goal are a strengthening of the capability of the social science research system to provide

knowledge to the water management system, coupled with a strengthening of the capability of the water management system to make use of it.

Three kinds or stages of organizational interpenetration between the systems are described. *One* is that of water management organizations to the social science research system as represented by the support or commissioning of research activity. *Two* is the reverse penetration, that is, the carrying out of social science research relevant to water management. *Three* is joint interpenetrations and represents the application of social science research in water management settings.

The goal aspects together with the kinds of interpenetration provide a common denominator for water managers to assess the kinds of social science research programs they should support, from both the substantive and organizational standpoints.

The strategy is designed to provide a means to assess explicitly and relate many critical factors which, although often recognized implicitly, are only taken into account in a haphazard manner at present.

It was suggested in the introduction that a review of social science research relevant to water resources could best be used in conjunction with a planning strategy which recognized the incalculable nature of the problem of water resources management. Such a strategy has been put forward in this paper.

References

1. Gross, Bertram M., *The Management of Organizations*, New York: Free Press, 1964, Chapters 2 and 3.
2. The use of the term "meta-problem" here parallels the usage of Warren Bennis when he speaks of "meta-goals [which] transcend, underlie, and shape explicit goals". See "Goals and Meta-Goals of Laboratory Training", *Human Relations Training News*, No. 3 (Washington: National Training Laboratories, 1962). It is also discussed in Michel Chevalier, "Towards an Action Framework for the Control of Pollution", a background paper prepared for the Canadian Council of Resource Ministers Conference on Pollution (Montreal, 1966), pp. 2f.
3. Gross, Bertram M., *op. cit.*, p. 761; italics added.
4. *Ibid.*, p. 517.
5. This argument is developed more fully in Braybrooke and Lindblom, who argue for a strategy of what they call, "disjointed incrementalism". See Braybrooke, David and Lindblom, C.E., *The Strategy of Decision*, New York: Glencoe Free Press, 1963, Chapter 5. See also a newer work by Lindblom, *The Intelligence of Democracy: Decision-making Through Mutual Adjustment*, New York: Glencoe Free Press, 1965.
6. For a more complete discussion of the need and potential in Canada for exploitation of resource opportunities in the context of regional development, see Brewis, T.N., and Paquet, Gilles, *Regional Development and Planning in Canada: An Exploratory Essay*, *Canadian Public Administration* (Summer 1968).
7. Theobald, Robert, *The Challenge of Abundance*, Toronto: New American Library of Canada, 1961. 8.
8. See Wilensky, Harold I., for a general discussion of the relationships of new knowledge (or intelligence) to the organization, *Organizational Intelligence*, Cambridge: M.I.T. Press, 1967, pp. 41-74. Merton, R.K., "Bureaucratic Structure and Personality", in Merton, *et al.*, *Reader in Bureaucracy*, New York: Free Press, 1952, pp. 366-67, discusses the dynamic identity of bureaucracies, while the adaptability of the bureaucracy to the challenges of new problems is discussed in Michel Chevalier, *op. cit.*
9. North, Holsti, Zaninovich and Dinnes, *Content Analysis, A Handbook with Applications for the Study of International Crisis*, Chicago: Northwestern Univ. Press, 1963, p. 5.
10. A synopsis, *The Managing of Organizations*, *op. cit.* This quotation from p. 5 of the Synopsis (mimeo., Maxwell School, University of Syracuse) refers to Chapter 20, "The Satisfaction of Interests", pp. 502-537.
11. Bennis, Warren G., *Trans-action*, July-August, 1965.
12. Wilensky, Harold I., *op. cit.*, p. 98.
13. Bennis, Warren G., *et al.* (eds.), *The Planning of Change*, New York: Holt, Rinehart and Winston, 1961, p. 223.
14. See Merton, Robert K., *Social Theory and Social Structure*, New York: Free Press, 1956, Chapters 8 and 9, where he discusses reference group theory. See also Michel Chevalier, "The Dynamics of Adaptation in the Federal Public Service" (Royal Commission on Bilingualism and Biculturalism, Ottawa, 1966), Appendix IV, for a similar concept – a role identification scale.

15. Kaplan, Abraham, *The Conduct of Inquiry*, San Francisco: Chandler, 1964, pp. 28-29; "Give a small boy a hammer and he will find that everything he encounters needs pounding". He mentions this in the context of scientific method.
16. Bales, R.F., defines small groups as follows in *Interaction Process Analysis: A Method for the Study of Small Groups*, Reading, Mass.: Addison-Wesley, 1950, p. 33: "Any number of persons engaged in interaction with each other in a single face-to-face meeting or a series of meetings, in which each member receives some impression or perception of each other member . . .".
17. For example, Hare discusses the communication network in small groups. Hare, A.P., *Handbook of Small Group Research*, New York: The Free Press, 1962, Chapter 10.
18. Hare, *op. cit.*, p. 115.
19. *Ibid.*, p. 217.
20. *Ibid.*, p. 309.
21. Braybrooke and Lindblom, *op. cit.*, pp. 140 f.
22. See Chevalier, Michel, *et al.*, "The Dynamics of Adaptation in the Federal Public Service", *op. cit.*, Appendix IV.
23. Churchman, C. West and Emery, F.E., "On Various Approaches to the Study of Organizations", *Proceedings of the International Conference on Operational Research and the Social Sciences*, Cambridge, England, 1964.
24. Carroll, James D. discusses "the process values in university research" as related to product values in *Science*, November 24, 1967, p. 1019. He suggests that federal politics (in the United States) tend to be directed more and more toward the resolution of emerging social issues, that they are innovative, policy politics. He notes that federal programs to support process value university research should be distinguished from product value programs, and that this distinction is beginning to emerge.
25. *Social Research and a National Policy for Science*, London: Tavistock Publication, 1964, Appendix 1, describes how joint interpenetration can be considered in the light of a "professional model" in the social sciences: ". . . The relation between the 'pure' and the 'applied' is different in the case of the social sciences as compared with the natural sciences. This difference crucially affects the conditions that the social sciences require for their development and needs to be understood if such development is to take place . . . In the natural sciences, the fundamental data are reached by abstracting the phenomena to be studied from their natural contexts and submitting them to basic research through experimental manipulation in a laboratory. It is only some time later that possible applications may be thought of, and it is only then that a second process of applied research is set under way. The social scientist can use these methods only to a limited extent. On the whole he has to reach his fundamental data [people, institutions, etc.] in their natural state, and his problem is how to reach them in that state. His means of gaining access is through a professional relationship which gives him privileged conditions. The professional relationship is a first analogue of the laboratory for the social sciences. Unless he wins conditions privileged in this way, the social scientist cannot find out anything that the layman cannot find out equally well, and he can earn these privileges only by proving his competence in supplying some kind of service. In a sense, therefore, the social scientist begins in practice, however imperfect scientifically, and works back to theory and the more systematic research which may test this, and then back again to improved practice. Though this way of working is well understood in the case of medicine, it is not so well understood even among social scientists, that the same type of model applies to a very wide range of social science activities. The model may in fact be called the 'professional mode'!"

POLICY AND PLANNING BRANCH PUBLICATIONS

Forecasting the Demands for Water. By W.R. Derrick Sewell and Blair T. Bower,
et al. Ottawa, 1969. 262 pp. *Price \$1.50*

Water Management Research: Social Science Priorities. By W.R. Derrick Sewell,
Richard W. Judy and Lionel Ouellet. Ottawa, 1969. 145 pp. *Price \$2.00*

Available from the Queen's Printer, Ottawa, on prepayment.